Claims

1. A method for measuring in a dynamic sequence of medical images of a
moving body part, the method comprising:

defining at least one measurement point in the moving body part in
one of said images;

defining a reference point in one of said images to a point being fixed
relative to an image geometry, said reference point being different from
said at least one measurement point;

automatically tracking the at least one measurement point in all of
said images of the sequence;

automatically indicating the reference point in all of said images of the
sequence;

automatically determining a length and a direction of at least one
vector extending from the reference point to one of the at least one
measurement points for each pair of reference point and one
measurement point in all of said images of the sequence, and

automatically determining at least one of a rate of change of said
length and said direction of said at least one vector between selected
images in said sequence of images.

2. The method according to claim 1, further comprising:

automatically determining at least one first distance between the
reference point and one of the at least one measurement points for each
pair of one reference point and one measurement point using the length
of the corresponding vector.

3. The method according to claim 1, further comprising:

automatically determining a direction of movement of the at least one
measurement point by using the direction of the corresponding vector.

4. The method according to claim 2, further comprising:

automatically determining a direction of movement of the at least one
measurement point by using the direction of the corresponding vector.

5. The method according to claim 1, further comprising:

automatically determining a speed of the at least one measurement point by using said rate of change of the length of the corresponding vector.

5   6. The method according to claim 4, further comprising:
automatically determining a speed of the at least one measurement point by using said rate of change of the length of the corresponding vector.

10   7. The method according to claim 1, further comprising:
automatically determining at least one of an acceleration and a retardation of the at least one measurement point by using said rate of change of the length of the corresponding vector.

15   8. The method according to claim 6, further comprising:
automatically determining at least one of an acceleration and a retardation of the at least one measurement point by using said rate of change of the length of the corresponding vector.

20   9. The method according to claim 1, further comprising:
automatically comparing at least one of said rate of change of said length and said direction of said at least one vector between selected images in said sequence of images.

25   10. The method according to claim 2, further comprising:
automatically comparing said at least one first distance between selected images in said sequence of images.

        11. The method according to claim 5, further comprising:
30   automatically comparing said speed between selected images in said sequence of images.

        12. The method according to claim 7, further comprising:
automatically comparing the at least one of acceleration and
35   retardation between selected images in said sequence of images.

        13. The method according to claim 3, further comprising:

automatically comparing said direction of movement between selected images in said sequence of images.

14. The method according to claim 1, wherein the step of defining at least one measurement point in the moving body part in one of said images comprises defining at least two measurement points.

15. The method according to claim 14, further comprising:
automatically determining a second distance between two of the at least two measurement points for each pair of two measurement points using said lengths of the corresponding vectors.

16. The method according to claim 15, further comprising:
automatically comparing said second distance between selected images in said sequence of images.

17. The method according to claim 2, wherein the step of defining at least one measurement point in the moving body part in one of said images comprises defining at least two measurement points.

18. The method according to claim 17, further comprising:
automatically determining a second distance between two of the at least two measurement points for each pair of two measurement points using the first lengths of the corresponding vectors.

19. The method according to claim 18, further comprising:
determining at least one dynamic angle using at least one of said first distance and said second distance.

20. The method according to claim 18, further comprising:
determining an area using at least one of said first distance and said second distance.

21. The method according to claim 19, further comprising:
determining an area using at least one of said first distance and said second distance.

22. The method according to claim 1, wherein the step of automatically tracking the at least one measurement point is preceded by a step of creating in each of said images a one-dimensional search field for the tracking of each of the at least one measurement points.

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23. The method according to claim 8, wherein the step of automatically tracking the at least one measurement point is preceded by a step of creating in each of said images a one-dimensional search field for the tracking of each of the at least one measurement points.

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24. The method according to claim 1, wherein the step of automatically tracking the at least one measurement point is preceded by a step of creating in each of said images a two-dimensional search field for the tracking of each of the at least one measurement points.

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25. The method according to claim 8, wherein the step of automatically tracking the at least one measurement point is preceded by a step of creating in each of said images a two-dimensional search field for the tracking of each of the at least one measurement points.

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26. The method according to claim 1, wherein the step of automatically tracking the at least one measurement point is preceded by a step of creating in each of said images a time resolved two-dimensional search field for the tracking of each of the at least one measurement points.

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27. The method according to claim 8, wherein the step of automatically tracking the at least one measurement point is preceded by a step of creating in each of said images a time resolved two-dimensional search field for the tracking of each of the at least one measurement points.

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28. The method according to claim 26, wherein the step of creating in each of said images a time resolved two-dimensional search field for the tracking of the at least one measurement point further comprises creating the search field using information from at least one of previous and following

35   images in said sequence of images.

29. The method according to claim 26, wherein the step of creating in each of said images a time resolved two-dimensional search field for the tracking

of the at least one measurement point further comprises creating the search field using expected values based on information from the previous image in said sequence of images.

5   30. The method according to claim 14, wherein the step of automatically tracking the at least two measurement points is preceded by a step of creating in each of said images any combinations of one-dimensional search fields, two-dimensional search fields and time resolved two-dimensional search fields for the tracking of the at least two

10   measurement points.

31. The method according to claim 1, wherein the step of automatically tracking the at least one measurement point is preceded by a step of image processing increasing the contrast between a reproduced object

15   and a background.

32. The method according to claim 1, wherein the step of automatically tracking the at least one measurement point comprises using image processing software comprising at least one algorithm tracking the at

20   least one measurement point.

33. A method for generating a dynamic sequence of medical images of a moving body part and measuring in said dynamic sequence, the method comprising:

25   scanning a portion of a body of a patient including the moving body part for generating time resolved projection data;

generating said images from said projection data;

defining at least one measurement point in the moving body part in one of said images;

30   defining a reference point in one of said images to a point being fixed relative to an image geometry, said reference point being different from said at least one measurement point;

automatically tracking the at least one measurement point in all of said images of the sequence;

35   automatically indicating the reference point in all of said images of the sequence;

automatically determining a length and a direction of at least one vector extending from the reference point to one of the at least one

measurement points for each pair of reference point and one measurement point in all of said images of the sequence, and

automatically determining at least one of a rate of change of said length and said direction of said at least one vector between selected

5   images in said sequence of images.

34. The method according to claim 33, further comprising:

automatically determining at least one first distance between the reference point and one of the at least one measurement points for each

10   pair of one reference point and one measurement point using the length of the corresponding vector.

35. The method according to claim 33, further comprising:

automatically determining a direction of movement of the at least one

15   measurement point by using the direction of the corresponding vector.

36. The method according to claim 34, further comprising:

automatically determining a direction of movement of the at least one measurement point by using the direction of the corresponding vector.

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37. The method according to claim 33, further comprising:

automatically determining a speed of the at least one measurement point by using said rate of change of the length of the corresponding vector.

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38. The method according to claim 36, further comprising:

automatically determining a speed of the at least one measurement point by using said rate of change of the length of the corresponding vector.

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39. The method according to claim 33, further comprising:

automatically determining at least one of an acceleration and a retardation of the at least one measurement point by using said rate of change of the length of the corresponding vector.

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40. The method according to claim 38, further comprising:

automatically determining at least one of an acceleration and a retardation of the at least one measurement point by using said rate of change of the length of the corresponding vector.

41. The method according to claim 33, further comprising:
    automatically comparing at least one of said rate of change of said length and said direction of said at least one vector between selected images in said sequence of images.

42. The method according to claim 34, further comprising:
    automatically comparing said at least one first distance between selected images in said sequence of images.

43. The method according to claim 37, further comprising:
    automatically comparing said speed between selected images in said sequence of images.

44. The method according to claim 39, further comprising:
    automatically comparing said at least one of acceleration and retardation between selected images in said sequence of images.

45. The method according to claim 35, further comprising:
    automatically comparing said direction of movement between selected images in said sequence of images.

46. The method according to claim 33, wherein the step of defining at least one measurement point in the moving body part in one of said images comprises defining at least two measurement points.

47. The method according to claim 46, further comprising:
    automatically determining a second distance between two of the at least two measurement points for each pair of two measurement points using said lengths of the corresponding vectors.

48. The method according to claim 47, further comprising:
    automatically comparing said second distance between selected images in said sequence of images.

49. The method according to claim 34, wherein the step of defining at least one measurement point in the moving body part in one of said images comprises defining at least two measurement points.

50. The method according to claim 49, further comprising:
automatically determining a second distance between two of the at least two measurement points for each pair of two measurement points using the first lengths of the corresponding vectors.

51. The method according to claim 50, further comprising:
determining at least one dynamic angle using at least one of said first distance and said second distance.

52. The method according to claim 50, further comprising:
determining an area using at least one of said first distance and said second distance.

53. The method according to claim 51, further comprising:
determining an area using at least one of said first distance and said second distance.

54. The method according to claim 33, wherein the step of automatically tracking the at least one measurement point is preceded by a step of creating in each of said images a one-dimensional search field for the tracking of each of the at least one measurement points.

55. The method according to claim 40, wherein the step of automatically tracking the at least one measurement point is preceded by a step of creating in each of said images a one-dimensional search field for the tracking of each of the at least one measurement points.

56. The method according to claim 33, wherein the step of automatically tracking the at least one measurement point is preceded by a step of creating in each of said images a two-dimensional search field for the tracking of each of the at least one measurement points.

57. The method according to claim 40, wherein the step of automatically tracking the at least one measurement point is preceded by a step of

creating in each of said images a two-dimensional search field for the tracking of each of the at least one measurement points.

58. The method according to claim 33, wherein the step of automatically tracking the at least one measurement point is preceded by a step of creating in each of said images a time resolved two-dimensional search field for the tracking of each of the at least one measurement points.

59. The method according to claim 40, wherein the step of automatically tracking the at least one measurement point is preceded by a step of creating in each of said images a time resolved two-dimensional search field for the tracking of each of the at least one measurement points.

60. The method according to claim 58, wherein the step of creating in each of said images a time resolved two-dimensional search field for the tracking of the at least one measurement point further comprises creating the search field using information from at least one of previous and following images in said sequence of images.

61. The method according to claim 58, wherein the step of creating in each of said images a time resolved two-dimensional search field for the tracking of the at least one measurement point further comprises creating the search field using expected values based on information from the previous image in said sequence of images.

62. The method according to claim 46, wherein the step of automatically tracking the at least two measurement points is preceded by a step of creating in each of said images any combinations of one-dimensional search fields, two-dimensional search fields and time resolved two-dimensional search fields for the tracking of the at least two measurement points.

63. The method according to claim 33, wherein the step of automatically tracking the at least one measurement point is preceded by a step of image processing increasing the contrast between a reproduced object and a background.

64. The method according to claim 33, wherein the step of automatically tracking the at least one measurement point comprises using image processing software comprising at least one algorithm tracking the at least one measurement point.

65. A system for measuring in a dynamic sequence of medical images of a moving body part, said system comprising means for:

defining at least one measurement point in the moving body part in one of said images;

defining a reference point in one of said images to a point being fixed relative to an image geometry, said reference point being different from said at least one measurement point;

automatically tracking the at least one measurement point in all of said images of the sequence;

automatically indicating the reference point in all of said images of the sequence;

automatically determining a length and a direction of at least one vector extending from the reference point to one of the at least one measurement points for each pair of reference point and one measurement point in all of said images of the sequence, and

automatically determining at least one of a rate of change of said length and said direction of said vector between selected images in said sequence of images.

66. A system for generating a dynamic sequence of medical images of a moving body part and for measuring in said dynamic sequence, said system comprising means for:

scanning a portion of a body of a patient including the moving body part for generating time resolved projection data;

generating said images from said projection data;

defining at least one measurement point in the moving body part in one of said images;

defining a reference point in one of said images to a point being fixed relative to an image geometry, said reference point being different from said at least one measurement point;

automatically tracking the at least one measurement point in all of said images of the sequence;

automatically indicating the reference point in all of said images of the sequence;

automatically determining a length and a direction of at least one vector extending from the reference point to one of the at least one measurement points for each pair of reference point and one measurement point in all of said images of the sequence and,

automatically determining at least one of a rate of change of said length and said direction of said at least one vector between selected images in said sequence of images.

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67. The system according to claim 66, wherein the scanning is performed by a X-ray device.